



Activity 4

Evaluating Claims About Cancer

Focus: Students identify claims about UV exposure presented in a selection of media items, then design, execute, and report the results of an experiment designed to test one such claim.

Major Concepts: Scientists use systematic and rigorous criteria to evaluate claims about factors associated with cancer. Consumers can evaluate such claims by applying criteria related to the source, certainty, and reasonableness of the supporting information.

Objectives: After completing this activity, students will

- understand that many people and organizations make claims about factors associated with the development of cancer and about agents that may help prevent or cure cancer;
- be able to explain that scientists evaluate such claims by applying systematic and rigorous criteria;
- be able to apply criteria such as the source, certainty, and reasonableness of the supporting information to media claims about cancer; and
- recognize that understanding the biology of cancer and the nature of science can help individuals and society make reasoned choices about factors related to cancer.

Prerequisite Knowledge: Students should have sufficient understanding of the methods of science to develop a hypothesis, design an experiment to test that hypothesis, and draw reasonable conclusions from the results.

Basic Science-Public Health Connection: This activity provides the opportunity for students to discover how science can help individuals and society evaluate claims about cancer.

Although most of your students will never acquire or need a detailed understanding of the biology of cancer, all of them will need to understand and evaluate claims about cancer that they encounter in casual conversation, in media items, and even in reports from health care workers. Some of these claims may be vague, either in substance or in origin. Some may be exciting and seem to offer great hope. Others may be alarming. In some cases, these claims may conflict.

How do scientists evaluate claims about cancer? And how can your students, as scientifically literate citizens, evaluate such claims, both for their own satisfaction and as a solid foundation for thinking about and voting on policy issues?

In this activity, students examine several media items about exposure to the sun and the development of skin cancer and work in teams to identify the claims

At a Glance

Introduction

that each media item makes. Students are challenged to describe ways that scientists might evaluate these claims, and then are introduced to a model system involving UV (ultraviolet light)-sensitive yeast that they can use to test aspects of these claims. Each team designs, executes, and presents the results of a controlled experiment testing one of these aspects. The activity ends with a class discussion of (1) how scientists evaluate claims about cancer and (2) the criteria that nonscientists can use to evaluate such claims.

Materials and Preparation

You will need to prepare materials in advance for the laboratory exercise. Ordering information and preparation directions are on page 70, immediately following the activity.

You will need to prepare the following additional materials before conducting this activity:

- Master 4.1, *Media Item 1* (make enough for one-fourth of the class)*
- Master 4.2, *Media Item 2* (make enough for one-fourth of the class)*
- Master 4.3, *Media Item 3* (make enough for one-fourth of the class)*
- Master 4.4, *Media Item 4* (make enough for one-fourth of the class)*
- Master 4.5, *Using a Model System to Test Claims About UV Light* (make 1 copy per student)
- Master 4.6, *Evaluating Claims About Cancer* (make 1 copy per student)

*You will need one *Media Item* handout for each student in your class. Note that every student in one team gets the same handout, but different teams get different handouts.

Procedure

DAY 1

1. **Ask students to organize into teams. Distribute the masters so that each team has a different master; each member of a particular team should have the same master.**
2. **Direct students to read their media items, then work together to identify the major claims that their assigned item makes about the product, ultraviolet (UV) light, and cancer. Ask students also to describe the evidence on which these claims seem to be based.**

Give the teams about 5 minutes for this discussion.

3. **Conduct a brief class discussion about the media items by asking the following questions:**
 - **What claims did you find in the media items? What evidence did the items provide to support these claims?**

Students should not find it difficult to identify these claims. Possible answers include the following:

- *Media Item 1:* A new sunscreen gives 10 times more protection against sunburn than others, but still allows tanning.
- *Media Item 2:* A new brand of sunglasses protects eyes against UV light.
- *Media Item 3:* Cellophane protects against sunburn but still allows tanning.
- *Media Item 4:* Some clothing offers higher protection from UV light than other clothing.

The media items do not provide any evidence to support these claims.

- **What claims about such products and/or cancer have you heard during your lifetime? From whom (and where) do you hear such claims?**

Students likely have heard many claims. Allow them to list not only outlandish claims that they may have heard in the media, but also more reasonable claims that they may have heard from parents, friends, and even reputable magazines and health care professionals. Technically, any information that we hear or read about cancer is a “claim” that someone is making.

- **How do scientists evaluate such claims?**

Students should already understand that scientists evaluate such claims through rigorous experimentation, the requirement of evidence to support a claim, careful review by other scientists of procedures and conclusions, and the requirement that results be replicable. Look for these and similar answers from your students; if they are not forthcoming, ask probing questions such as “Is it sufficient for a scientist to make a claim without providing evidence to back it up?” and “If certain results can be obtained only by one scientist working in a particular laboratory, what would you think of claims based on these results?”

4. **Explain that in this activity, students will have an opportunity to test claims that are similar to those they encountered in their media items and will learn questions that citizens can ask about claims they hear in the popular press and from other sources.**
5. **Distribute one copy of Master 4.5, *Using a Model System to Test Claims About UV Light*, to each student. Ask students to work in their teams to design and conduct a controlled experiment that tests a claim related to their media item.**

You may wish to explain that often scientists use model systems to evaluate certain claims that would not be appropriate to test using people as subjects. Often, these model systems involve other species. In this activity, students will use yeast as their model system.



Students have the opportunity here to experience how scientific experiments can lead to reasonable claims about how individuals can help prevent skin cancer. Point out that basic experiments, such as the one they are about to conduct, have led to a variety of actions on behalf of public health, including the banning of certain food additives and warnings they see on consumer products.

Circulate through the room as students read the information provided on *Using a Model System* and begin to design and execute their experiments. Notice that students will not be able to test the actual claims their media items make, but should be able to test related claims. You may have to ask probing questions to help students see how to use the yeast to test these claims. Following are suggestions for possible experiments:

- *Media Item 1:* Students can test the relative abilities of different brands of sunscreen or different SPF values to protect the yeast from UV light.
- *Media Item 2:* Students can test the relative abilities of different brands and types of sunglasses to protect the yeast from UV light.
- *Media Item 3:* Students can test the relative abilities of different colors of cellophane to protect the yeast from UV light.
- *Media Item 4:* Students can test the relative abilities of different colors and thicknesses of cloth to protect the yeast from UV light.

Tip from the field test. Although students will only be able to test certain aspects of the claims each media item makes, you may wish to challenge your students to identify what part(s) of the claim they are *not* testing and to describe how they might test those parts of the claim.

6. **Conclude Day 1 by asking each team to describe to the class the claim they are testing and the method they are using to test the claim.**

DAY 2

1. **Direct students to collect the plates from their experiments and record their results. Then convene a class discussion and ask each team to report briefly on its experiment. As each team reports, ask students what additional information they would need to be able to answer the experimental question more completely or to be able to apply their findings to humans.**

Students should follow the outline provided in *Using a Model System* as they report on their experiments.

2. **Acknowledge the value of scientific research in evaluating claims, then ask students how nonscientists can evaluate similar claims that they encounter in the media or from other sources. List their ideas on the board or a transparency.**

Students should recognize that they do not have the expertise, equipment, or time to experimentally evaluate each claim that they hear about cancer, but they can carefully consider claims to determine their source, whether they are supported by evidence, and how reasonable they are (that is, whether they seem to fit within existing knowledge or seem outlandish). Sometimes “outlandish” claims are correct, but this usually is not the case, and students should understand this.

3. Challenge each team to use the results of its own experiment to develop a media item similar to the item they used in Step 1. Point out that this item does not need to sell something but can be designed to inform the public about the results of their work. Remind teams to use the list the class generated in Step 2 as a guide for writing credible claims.
4. Distribute one copy of Master 4.6, *Evaluating Claims About Cancer*, to each student. Explain that this worksheet provides a set of questions that can help the scientifically literate citizen evaluate claims about science and health. Ask teams to exchange the media items they developed in Step 3 and to evaluate them by answering the questions on *Evaluating Claims*.
5. Invite partner teams to meet and share their analyses of their media items.

Remind students that useful feedback identifies both good features and features that need to be refined, and also provides specific suggestions for refinement.

Give students about 5 minutes for this discussion. Circulate among the teams during their discussions and ask questions or make suggestions as appropriate. You may wish to challenge teams to revise their media items based on the feedback they receive.

6. Close the activity by asking students how understanding the biology of cancer and the nature of science can help individuals and society make reasoned choices about factors related to cancer.

Students should be able to explain that scientific research identifies risk factors for cancer (for example, UV radiation) and also develops and tests products designed to protect against cancer (for example, sunscreen). Students should also recognize that understanding how scientists test claims and that being familiar with the requirements of evidence can help scientifically literate citizens evaluate claims they hear about cancer.

Invite students to bring in samples of other media items, including Web-based advertisements, for the class to evaluate using the criteria developed in Day 2, Step 2 and the questions on Master 4.6, *Evaluating Claims About Cancer*.



Collect teams' media items here, or after they refine the items based on feedback they receive in Step 5, to assess students' understanding that credible claims are supported by evidence.



Asking students how science helps people make choices about factors related to cancer leads them back to one of the activity's major concepts.

Potential Extensions

Laboratory Preparation

1. *Four weeks before conducting the laboratory exercise.* Order the following from Carolina Biological Supply:

- a. YED yeast strain G948-IC/U, catalog # CD-17-3634
- b. YED agar medium, catalog # CB-17-3650

Allow two weeks for delivery. Carolina Biological Supply will only ship live materials on Mondays, Tuesdays, and Wednesdays.

2. *Up to one week before conducting the laboratory exercise.* Prepare petri plates containing YED agar medium following the directions on the package. You will need 1 plate per student plus 1 additional plate per team; we recommend preparing extra plates to allow for mistakes and contamination.

Prepare the plates up to 1 week in advance (depending on the humidity) and allow them to sit at room temperature. The agar must dry out enough to absorb the 1 ml sample students will plate.

3. Prepare the following additional materials:

- 1-ml sterile calibrated bulbed transfer pipets (1 per student)
- sealed tubes containing 10 to 15 ml of sterile water (1 per team)
- alcohol wipes
- 10 to 15 toothpicks, wrapped in aluminum foil and sterilized (1 packet per team)
- assortment of sunscreen brands and SPF values
- assortment of sunglasses, including those that do and do not claim protection from UV light
- cellophane wrap in several colors (transparent, yellow, red, blue, and green)
- fabric of varying colors and thicknesses
- aluminum foil
- black construction paper
- masking or transparent tape

4. *One or two days before conducting the laboratory exercise.* Following aseptic technique, streak yeast strain G948-IC/U onto 1 YED agar plate for each team. (Again, you may want to make several extra cultures.)

- a. Hold an inoculating loop in the flame of a Bunsen burner until it is red hot.
- b. Open and flame the mouth of the yeast culture tube and touch the loop to an inside wall of the tube to cool it. Then scoop some of the yeast onto the loop. Flame the mouth of the culture tube again and replace the lid.
- c. Gently drag the loaded inoculating loop across the surface of a YED agar plate.
- d. Repeat the procedure for subsequent plates.

Incubate the cultures in the dark overnight at 30°C.